

REMARKS

A. Background

Claims 1-13 were pending in the application at the time of the Office Action. Claims 1-13 were rejected as being anticipated by and/or obvious over cited art. By this response applicant has cancelled claim 2; and amended claims 1 and 4-7. As such, claims 1 and 3-13 are presented for the Examiner's consideration in light of the following remarks.

B. Proposed Claim Amendments

Applicant has herein amended claims 1 and 4-7 to further clarify, more clearly define, and/or broaden the claimed inventions to expedite receiving a notice of allowance. For example, claims 4, 6, and 7 now recite "a wave propagation medium for outputting input-light that is launched into an input port to an output port as output-light, said input port and output port each being defined as a location of a circuit at which a cross section of a field of said input-light or said output-light is given in a cross section perpendicular to a propagation direction of said input-light." and claims 1, 4, 6, and 7 have been amended to clarify that "the wave propagation medium has a spatial refractive index distribution for outputting the leakage light launched into the circuit element to other port as output-light with multiple scattering through the wave propagation medium, said spatial refractive index distribution is designated by each refractive index of pixels defined by a mesh, said each refractive index of the pixels is determined by calculating a phase difference between a forward propagation of the input field of the leakage light and a reverse propagation of the output field of the output-light at each pixel and repeating calculations until said phase difference becomes less than a desired value." These amendments

to the claims are supported in the application at least by paragraphs [0019]-[0040] of the specification.

In view of the foregoing, applicant submits that the amendments to the specification, drawings, and claims do not introduce new matter and entry thereof is respectfully requested.

C. Rejections Based on 35 USC § 102

Pages 2 and 3 of the Office Action reject claims 1-4 under 35 USC § 102(b) as being anticipated by U.S. Publication No. 2005/0200942 to Grot et al. ("*Grot*"). Page 3 of the Office Action rejects claims 1-5 under 35 USC § 102(b) as being anticipated by U.S. Publication No. 2004/0213536 to Zoorob et al. ("*Zoorob*"). Pages 4-5 of the Office Action reject claims 6, 7, 9, 10, 12 and 13 under 35 USC § 102(e) as being anticipated by U.S. Publication No. 2006/0067619 to Welch et al. ("*Welch*"). Inasmuch as claim 2 has been canceled herein, the rejection of that claim has been rendered moot. Regarding the rest of the rejected claims, Applicant respectfully traverses this rejection and submits that none of *Grot*, *Zoorob*, and *Welch* anticipate the rejected claims because none of *Grot*, *Zoorob*, and *Welch* includes each and every claim limitation recited in the rejected claims. Of the rejected claims, claims 1, 4, 6, and 7 are independent claims.

The inventions set forth in independent claims 1, 4, 6 and 7 comprise the wave transmission medium having a spatial refractive index distribution designated by each refractive index of pixels defined by a mesh. The spatial refractive index distribution is determined such that the input-light launched into the input port propagates through the wave propagation medium with multiple scattering and is outputted from the output port as the output-light. See paragraph [0020] of the specification. Specifically, the refractive index distribution is configured

by a mesh having wavelength (or subwavelength) spacings along the light propagation direction which also has a wavelength spacing (or subwavelength) in a traverse direction. In the holographic wave transmission medium, the wave having phase information is controlled by the refractive index of the pixels (local holographic control), and repeatedly phase controlled by each pixel along the propagation path to propagate through the medium. See paragraph [0019].

In order to describe the above in more detail, we consider the case of modifying the refractive index in multiple points along the light propagation path, i.e., the case of controlling phase. In this case, according to the Huygens principle, a propagation of a point light source is modified and the refractive index distribution may be further modified in response to the above modification. Accordingly, these modifications also need to be incorporated. This process is represented by the calculation of the field in the repetitions of the loop in the flow illustrated in Fig. 2. A field incorporating a modification of a certain refractive index (once scattered field) further incorporates the effect caused by a modification of the refractive index in a different location (new scattering), thereby modifying the refractive index. A linear variation in a disturbance effect is generally known to be capable of being represented by a linear combination.

Accordingly, the spatial refractive index distribution can be designed by the repeated process of incorporating the linear variation for each loop, calculating the field, and calculating the refractive index distribution based on the result thereof in parallel incorporating multiple scattering. As such, the modification of the refractive index in multiple points along the light propagation path and the propagation of light by incorporating the effect correspond to the scattering in multi-stages (controlled multiple scattering).

For a detailed description of the invention, the concept of the global holographic control is set forth in paragraphs [0020] - [0024], and the method for determining the local holographic

control, i.e., the spatial refractive index distribution, is also set forth in the paragraphs [0025]-[0041]. This structure, by applying to an optical component that emits the input light into the desired port, can increase the effective optical path length by the interference due to the multiple scattering caused between the propagating waves in the medium. Consequently, an optical circuit with high optical signal controllability can be configured by the spatial refractive index distribution with gradual changes. See paragraph [0041].

In contrast to the present invention, the apparatuses set forth in *Grot* and *Zoorob* relate to photonic crystals. Photonic crystals are artificial crystals with periodical modulated dielectric constants. A light propagating through the photonic crystal is affected by potential scattering occurred by the periodical modulated dielectric constants and then has a photonic band structure. That is, the photonic crystals can be used to control inputted light by forming a photonic band structure. Thus, controlling by potential scattering is different from controlling by multiple scattering of the present invention.

In light of the above, Applicant submits that neither *Grot* nor *Zoorob* disclose nor suggest “the wave propagation medium has a spatial refractive index distribution for outputting the leakage light launched into the circuit element to other port as output-light with multiple scattering through the wave propagation medium, said spatial refractive index distribution is designated by each refractive index of pixels defined by a mesh, said each refractive index of the pixels is determined by calculating a phase difference between a forward propagation of the input field of the leakage light and a reverse propagation of the output field of the output-light at each pixel and repeating calculations until said phase difference becomes less than a desired value,” as recited in independent claims 1, 4, 6, and 7. Furthermore, Applicant submits that *Welch* also does not disclose or suggest the aforementioned limitations. Additionally, Applicant

submits that it would not be obvious to modify or combine *Grot* or *Zoorob*, or *Welch* to include those limitations. Accordingly, Applicant respectfully requests that the anticipation rejection with respect to claims 1, 4, 6, and 7 be withdrawn.

Claims 3, 5, 9, 10, 12, and 13 depend from claims 1, 4, 6, or 7 and thus incorporate the limitations thereof. As such, applicant submits that claims 3, 5, 9, 10, 12, and 13 are distinguished over the cited art for at least the same reasons as discussed above with regard to claims 1, 4, 6, and 7. Accordingly, Applicant respectfully requests that the anticipation rejection with respect to claims 3, 5, 9, 10, 12, and 13 also be withdrawn.

D. Rejections Based on 35 USC § 103

Page 6 of the Office Action rejects claims 8 and 11 under 35 USC § 103(a) as being unpatentable over *Welch* in view of U.S. Publication No. 2005/0254770 to Watanabe (“*Watanabe*”). *Watanabe* is cited simply for allegedly teaching a coupled optical part that is an optical fiber, and a member that is a glass block for fixing the optical fiber. Applicant respectfully traverses this rejection and submits that even if, *arguendo*, it would have been obvious to combine *Welch* and *Watanabe* in the allegedly obvious manner set forth in the Office Action, the resulting combination would still not teach or suggest all of the claim limitations.

Claims 8 and 11 respectively depend from claims 6 and 7 and thus incorporate the limitations thereof. As such, applicant submits that claims 8 and 11 are distinguished over the cited art for at least the same reasons as discussed above with regard to claims 6 and 7. That is, even if *Welch* and *Watanabe* were combined in the allegedly obvious fashion, the resulting combination would still not disclose or suggest the limitations discussed above. Accordingly,

Applicant respectfully requests that the obviousness rejection with respect to claims 8 and 11 be withdrawn.

No other objections or rejections are set forth in the Office Action.

E. Conclusion

Applicant notes that this response does not discuss every reason why the claims of the present application are distinguished over the cited art. Most notably, applicant submits that many if not all of the dependent claims are independently distinguishable over the cited art. Applicant has merely submitted those arguments which it considers sufficient to clearly distinguish the claims over the cited art.

In view of the foregoing, applicant respectfully requests the Examiner's reconsideration and allowance of claims 1 and 3-13 as amended and presented herein.

The Commissioner is hereby authorised to charge payment of any of the following fees that may be applicable to this communication, or credit any overpayment, to deposit account number 23-3178: (1) any filing fees required under 37 CFR § 1.16; (2) any patent application and re-examination processing fees under 37 CFR § 1.17; and/or (3) any post issuance fees under 37 CFR § 1.20. In addition, if any additional extension of time is required, which has not otherwise been requested, please consider this a petition therefore and charge any additional fees that may be required to deposit account number 23-3178.

In the event there remains any impediment to allowance of the claims which could be clarified in a telephonic interview, the Examiner is respectfully requested to initiate such an interview with the undersigned.

Dated this 4th day of November 2008.

Respectfully submitted,

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